Eur J Vasc Endovasc Surg **14** (Supplement A), 71–73 (1997)

Extra-anatomic Graft Infection in the Aortofemoral Area

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Introduction

Infection of extra-anatomic vascular prosthesis in the aortofemoral area is reported episodically in the literature so that its frequency is still uncertain, though in axillopopliteal grafts it was found to be 3.6%.[1] It is considered to be a benign disease with a good possibility of conservative treatment or segmental resection.[2] In our experience over 15 years we had the impression that this was not always so, and that differences existed in incidence, severity, evolution, ways of treatment and final outcome between cases operated upon for obstructive arterial disease and those treated by extra-anatomic bypass for the management of an infected aortic graft. Therefore we studied retrospectively a series of 213 consecutive patients in whom 225 grafts were implanted, analysing indications, treatment and outcome.

Patients and Methods

From November 1977 to June 1995, 213 patients were submitted to 225 extra-anatomic procedures for aortofemoral disease. Their age range was 52–84, with 146 men and 67 women. Diabetes was present in 29%, hypertension in 47% and smoking in 32%. Indications for extra-anatomic arterial repair were: poor general condition in 154 (72.3%), poor runoff in patients otherwise in good or reasonable general conditions in 43 (20.2%) and local conditions in 16 (7.5%). Local conditions were extreme obesity in one patient, multiple previous abdominal surgery in one, large and severe scarring in the groin from previous surgery in two, widespread cancer of the bladder with post-radiation sclerosis in one and infection of an aortic graft in 11. All the patients operated upon for reasons other than aortic graft infection had chronic arterial obstructive disease with rest pain and/or trophic changes (Fontaine 3rd and 4th stage). Acute cases are not included in this report.

The procedures and graft materials were as reported in Table 1. A vein graft was often used for a cross-femoral bypass but in a few cases also for an axillo-femoral bypass. Most of the composite grafts had an ePTFE or Dacron portion in the axillofemoral position and an additional segment of vein as a cross-femoral branch. In patients treated for an infected aortic graft axillofemoral/popliteal bypasses were carried out using only ePTFE (10) or dacron (one) grafts. Early and late extra-anatomic graft infection was generally and promptly identified on a clinical basis; however, Gram stain and culturing studies were applied in all cases and labelled leukocyte scintigraphy was carried out in four.

For all grafts which were patent on discharge, follow-up included clinical assessment and non-invasive investigations at 1 month, 3 months and every 6 months thereafter. When problems arose or were suspected through ultrasound investigation, angiography was advised. Four failing and 11 occluded grafts were

Table 1. Extra-anatomic procedures and graft material in the aortofemoral area: 225 grafts in 213 patients.

	No.	%
Axillobifemoral	159	70.7
Cross-femoral	56	25.0
Axillopopliteal	8	3.5
Obturator	2	0.8
ePTFE	79	35.1
Composite*	67	29.8
Autogenous vein	56	24.9
Dacron	14	6.2
Homologous vein	9	4.0

* Most of the composite grafts were done by ePTFE or Dacron in axillofemoral position and a segment of vein as a cross-femoral.

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1078–5884/97/SA0071+03 $12.00/0

Table 2. Early and late infection in 225 grafts in the aortofemoral area related to extra-anatomic procedure and graft material.

	n	%
Early infection	7/225	3.1
Late infection	1/187	0.5
Overall	8/225	3.6
Axillofemoral/popliteal graft infection	8	
ePTFE	7/79	8.8
Dacron	1/14	7.1

No infection was detected in composite, autogenous or homologous vein grafts.

treated by endovascular techniques, surgery or combined procedures.

Results

Early results show a mortality of 2.8% (six patients) and an occlusion rate of 9.8% (22 grafts). One detachment from the axillary artery was not due to infection and was promptly repaired. Early infection affected seven out of 225 grafts (3.1%). Late results were available in 176 patients (187 grafts) with a follow-up from 6 months to 15 years (a mean of 5 years). Mortality was 45% due mainly to cardiac problems, but also to cancer and respiratory diseases. Patency was 66%. Four pseudoaneurysms were not due to infection and were successfully repaired. One embolism of the upper limb was observed and corrected by transbrachial embolectomy in a patient with an occluded axillofemoral graft which was removed while the axillary was patch-repaired. Late infection was detected in only one case (0.5%).

Summarising the results as far as extra-anatomic grafts infection is concerned (Table 2) there was an overall incidence of infection of 8/225 grafts (3.6%.) All infected grafts were axillofemoral or axillopopliteal and all of them were ePTFE or Dacron, with an incidence of infection of 8.8% and 7.1%, respectively. No infection was detected in composite, autogenous or homologous vein grafts. Five of the early infections occurred in four patients who had an infected aortofemoral graft. Three had total graft infection with *Pseudomonas aeruginosa in* two and a highly virulent strain of candida in 1. One of these was treated by a Dacron axillopopliteal bypass in a one-stage procedure, including total removal of the previous aortofemoral bypass. The new graft became rapidly infected, and was removed and followed by major amputation and death. The other two patients had one unilateral and one bilateral axillofemoral/popliteal bypass as the first step of a staged procedure but although the abdominal graft was removed, their extra-anatomic grafts became infected, bled, had to be totally excised, and major amputation followed. One patient had an isolated groin infection of an aortobifemoral bypass (*Staphylococcus epidermidis*). The involved limb of the graft was removed and an ePTFE axilloprofunda femoris bypass lateral to the infected groin area was carried out. The distal part of this graft also became infected. A brief period of conservative treatment was tried, but lack of improvement required partial excision of the new graft and the completion of an axillopopliteal bypass plus a short jump bypass to the posterior tibial. The outcome was favourable and infection has not resurfaced almost 3 years later. The other two early infections occurred in two patients having ePTFE axillofemoral bypasses for chronic occlusive arterial disease. In one case *Staphylococcus aureus* was responsible for a proximal infection leading to anastomotic disruption. The axillary artery could not be saved and revascularisation of the upper limb was performed using a homologous vein subclavian-brachial bypass. Although the axillofemoral graft was totally excised, the lower limb remained reasonably viable and painless with the support of a spinal cord stimulation. The other patient had a mid-portion infection of an axillofemoral graft due to wound infection. Cultures were negative and only white blood cells were seen on Gram's stain.

Conservative treatment was used successfully. The wound and graft healed with no recurrence for 16 months when the patient died of a heart attack. Only one late infection was observed at 12 months in a patient treated for obstructive arterial disease. This was due to decubitus ulcer of the skin over the externally supported ePTFE graft. Cultures were negative and on Gram's stain only white blood cells appeared. Conservative treatment was instituted and both ulcer and graft healed with no recurrence after 2 years.

Discussion

The commonly accepted indications for extra-anatomic arterial reconstruction in the aortofemoral area are either the poor general conditions of the patient or local conditions such as multiple abdominal surgical procedures, or an infection, particularly an infected aortic graft.[4] We have also used a third indication, which is the presence of poor runoff[5] mainly identified by severe disease of the profunda femoris and its branches, poor collateral circulation to the vessels below the knee and/or occlusion of the popliteal artery. Under those circumstances a small calibre prosthesis should be used, choosing a graft material with the best possible chances to remain patent in spite of

Table 3. Incidence of infection in extra-anatomic grafts used to treat infected aortic grafts compared to those implanted for obstructive aortofemoral disease*.

Treatment of infected aortic graft				11
10	ePTFE	Infected	4	
				→5 (45%)
1	Dacron	Infected	1	
Five early infections → four unfavourable outcomes (1 death)				
Treatment of aortofemoral obstructive disease				82
69	ePTFE	Infected	3	
				→3 (3.6%)
13	Dacron	None infected		
Two early + one late infections → three favourable outcomes				

* Only ePTFE and Dacron grafts are considered since infection was not observed in other graft materials.

a low flow, i.e. vein as first choice with ePTFE or homologous vein second.

In our series 43 patients (20.2%) received an extra-anatomic procedure for the sole reason of poor runoff; however, 42 out of 154 classified as having "poor general condition" also had a poor runoff, taking the total number of cases with such an unfavourable haemodynamic condition to 85 (39.9%). This explains the large use of entirely venous grafts in our series (Table 1), not only for cross-femoral but occasionally also for axillofemoral bypasses, and of composite grafts with an axillofemoral ePTFE or Dacron segment and a venous cross-over to the side with the worse runoff. This possibly explains a good long-term patency of 66% over a mean follow-up of 5 years, and also why the incidence of extra-anatomic graft infection in our cases is low, with the exception of those used in the treatment of infected aortic grafts. No infection was observed in autogenous or homologous vein and in composite grafts. The eight infected grafts were all prosthetic. There is some evidence that ePTFE is less prone to infection than Dacron,[6] although antibiotic impregnated Dacron tubes seem somewhat better.[7] The striking difference was that between extra-anatomic prosthesis used to treat an infected aortic graft and those implanted to treat aortofemoral obstructive disease. Table 3 compares all ePTFE and Dacron grafts. They are divided according to the indication for their use: while four out of 10 ePTFE grafts used on an infected aortic graft became infected themselves, only three out of 69 implanted for obstructive arterial disease were affected. The same observation was true for Dacron. Overall the infection rate was 45% for the first group and 3.6% for the second group. Furthermore, the difference in the final results should be noticed: four unfavourable outcomes for five graft infections in the first group versus three favourable outcomes in the second group. Certainly the nature of the infecting micro-organism plays a crucial role, but it should also be considered that at the present time aortic grafts infected by low virulence agents are now more often treated by *in situ* replacement[8] changing the indications for an extra-anatomic bypass. When the infecting agent is of high virulence and a staged procedure is planned for a revascularisation through an axillofemoral/popliteal bypass and excision of an infected aortic graft, then the time interval might be sufficient to allow spreading of the sepsis to the new prosthesis.

Conclusions

Extra-anatomic grafts implanted to treat aortofemoral obstructive disease infection have a low frequency of infection which is relatively benign. Conservative treatment or partial excision with limb salvage is often possible. We believe that the extensive use of venous tissue significantly reduced the incidence of infection in extra-anatomic grafts. Conversely, infection is frequent in extra-anatomic grafts used to treat infected aortofemoral grafts due to highly virulent organisms, and the outcome was generally unfavourable. In such cases earlier detection of the aortic graft infection and staged procedures in rapid sequence might be the answer to this difficult problem. In extreme cases a one stage radical procedure (extra-anatomic bypass plus aortic graft excision) should still be considered.

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